

Ancient cosmetics and painting analysed by combination of complementary microanalysis techniques

Marine Cotte¹, Philippe Walter², Eléonore Welcomme², Pierre Bleuet¹, Armando V. Solé¹, Jean Susini¹

1 European Synchrotron Radiation Facility, BP220, 38043 Grenoble Cedex, France

2 Centre de Recherche et de Restauration des Musées de France, Palais du Louvre, 14 quai F. Mitterrand, 75001 Paris, France

Our research is focused on two different archaeological issues: the study of the **cosmetics** used in the Mediterranean geographic area along a period of time (going from the Egyptian antiquity to the Greco-Roman time). Cosmetics were of primary importance in the everyday life, not only in aesthetic context, but also in religious, ritual and medical practises. Second, the study of the pigments used in Northern European **paintings** at the beginning of the Renaissance (Cranach, Dürer, Grünewald, Holbein, etc.). The physical-chemical signatures of the pigments, grounds and binding media are necessarily related with relevant practises and art expertise in Europe at that time.

Several similarities exist between these two subjects. First, the chemical nature is quite the same: products are made of pigments, with the possible addition of a binding medium (e.g. oil). Second, the analytical problematics are common: we search to determine the chemical composition of the products (are they natural or artificial compounds? Where they come from?) and the manufacturing process (chemical/mechanical transformation, heating...). More generally, our aim is to identify some characteristic “paint-pot”, ingredients and practices used in a limited time and space. Besides, in addition to supply information on ancient know-how, knowledge about degradation process can be useful for conservators.

Due to the samples complexity and preciousness, a network of various micro-analytical techniques was employed. Experiments were performed at the ESRF, on the beam lines ID21, ID22 and ID18F, which provide a panel of micro-imaging techniques, with high spatial resolution and high sensitivity. **Micro X-ray fluorescence** was used to identify the trace elements, which enable sometimes to distinguish between natural ores and synthesised products and to determine geographic provenances of minerals. **Micro X-ray diffraction** is a relevant method to analyse crystallised compounds and identify phases. **Micro XANES** analyses were performed at the sulphur and manganese K-edge to identify the chemical composition of some cosmetics and paintings. **Infrared micro-spectroscopy** gives access simultaneously to organic and mineral phases. It was particularly useful to study the interaction products between oil and pigments. More generally, each technique can generate images. This fact is very important since it enables elemental and chemical co-localisations, hence an easier identification of components. In addition, inter-technique correlations are also very fruitful. Finally, the combination of complementary and quantitative synchrotron based techniques is a powerful way to study complex ancient chemicals.